PREFACE

The structure of a biological textile is determined by the needs of its intended usage or application. The main factors are function, biocompatibility, price, and product approval. Protective materials, external devices, implanted materials, hygiene products, and extracorporeal devices are just a few of the many application categories for bio-medical textiles. Examples of their products include uniforms, surgical drapes, bandages, pressure garments, prosthetic socks, sutures, vascular grafts, artificial ligaments, artificial liver, artificial kidney, artificial lung, diapers, sanitary napkins, and incontinence pads, and so on. Nonwoven-based bio-medical textiles are the material of choice for many tissue engineering and regenerative medicine applications. The main reasons for this are their extraordinary surface area, large void volume, outstanding permeability, and low production cost. Surgical masks, surgical gowns, surgical drapes, surgical gloves, hospital bed sheets, scaffolds, dentistry, and aesthetic applications are some of the current non-woven medical uses.

The process of making nanoparticles is known as nanoparticle synthesis. Modern scientists have used innovative and creative methods to create complex antibacterial and antiviral nano-systems based on metal oxides or intermetallic oxide complexes, such as TiO_2, SnO_2, ZnO_2, and SiO_2. Functionalization by conjugation to bioactive compounds like silver, copper, zinc, etc. is another step in the synthesis process. Humans have long been familiar with these physiologically active metals, also known as bio metals, in the form of 'grandma recipes'. In several dieses, household treatments for antibacterial and bactericidal purposes included salts, complexes, colloid particles, and 'silver' water. Silver nanoparticles (AgNPs), a chemically synthesised antibacterial agent, has consistently been chosen above other antibacterial components for imparting desired hygienic activities in the production of non-woven based nano composites due to its proactive performance. These composites are often used to make bandages, gloves, gowns, aprons, and other textile products for bio-medical use.

Chemical and physical methods have various drawbacks despite of their efficiency. The major includes; use a lot of energy resources and result in the production of hazardous waste and dangerous by-products. Problems with energy balance and dangerous by-products have been handled by employing totally green techniques or organically synthesising nanoparticles. Due to their widespread availability, cheap cost, and abundant supply of bio-reducing agents, plants and plant products such as extracts of tulsi, neem, aloe vera, etc. have emerged as the preferred option for the biosynthesis of nanoparticles in the current scenario

above other potential options. It is well known that Calotropis procera (CP) leaves are frequently used in rural areas for treating burns, fungus infections, and wound healing. They have significant naturally occurring antibacterial capability, although no statistical analysis has been done on it.

Thus, using silver nitrate ($AgNO_3$) and CP leave extract, two substances with proven antibacterial characteristics; an innovative silver nano composite was produced in the current work. The antibacterial activity of CP leave extract without AgNPs in non-woven composites was also investigated concurrently with their various physical, comfort-related, morphological, and elemental evaluations.

This thesis consists of **Five (5) Chapters**;

CHAPTER 1: '<u>Introduction</u>', addresses the relevant topics and explores in brief about the diverse demand, scope and development of nanocomposite textile materials, the significance of AgNPs in biomedical applications and their synthesis from many perspectives, the requirements of antibacterial characteristics in biomedical products. The research gap was identified, and defined the aim of the study. They are all important considerations taken care for the chapter.

CHAPTER 2: '<u>Literature Review</u>', contains a well compiled literature survey done related about research done in the field of bio-medical nanocomposites, nano-technology and nano-particles, synthesis of nanoparticles, and its analytical techniques. The facts and finding published in prior studies pertaining to this study endeavour are detailed.

CHAPTER 3: '<u>Materials and Methods</u>', describes experimental strategies for assembling and preparing the various materials used during this study, as well as the research methodologies adopted during the synthesis of AgNPs and preparation of nanocomposites. The materials used and the methodology used were as per need of experiment and spread into four phases. The Phase-I dealt with engineering elementary set-up and confirming competency of novel bio synthesized nanoparticles. Objective sets for the Phase-II was preparation of prototype nonwoven @AgNPs/CP nano-composite and validating its antibacterial activity. The Phase-III pilot trials were targeted to optimize AgNPs/CP colloidal constituents' add-on for antibacterial activities in nonwoven @PV-AgNPs/CP nano-composites. The Phase-IV was designed to develop prototype nano-composites by treating commonly used bio-medical nonwoven textile materials with an optimal AgNPs/CP colloidal

& evaluating their physical and functional characteristics as per ASTM standards. This can explore potential of new green way AgNPs/CP synthesis procedure and nanocomposite made on loading them.

CHAPTER 4: '<u>Results and Discussions</u>' covered various observations made for all the prepared samples which were collected through the various assessment processes, as well as their analysis. It provides in-depth discussion of phytochemical analysis of plant extracts, toxicity analysis of plant extracts and green synthesized nanoparticles, nanocomposites characterisation techniques for nanoparticle formation, and testing of nano-composites materials in relation to the different study's concern phase. A comparative analysis of the prepared nano-composites by their physical evaluations, low-stress qualities, comfort related features, UV transmission properties, and antibacterial assessments of the produced nano-composites were also addressed.

CHAPTER 5: '<u>Conclusions and Future scopes</u>', gives comprehensive conclusion derived during this research work relevant to green plants extract and AgNPs/CP nanoparticles treatments. The possible recommendations for the future extension work of this research; the vast span criterion remained untouched during this limiting time interval of PhD work- frame.